Table S1 The details of the sample sites selected for the study

Land use types	Restoration age (yr)	Numbers of sites	Slop(°)	Vegetation coverage（%）	Main vegetations
Slope cropland	0	3	19~24.5	-	*Setaria italic, Glycine max*
Orchardland	5	3	0	-	
	10	3	0	-	
	20	3	0	-	
Grassland	2	3	13~27	12~20	*Geranium wilfordii, Artemisia capillaris, Euphorbia humifusa,Setaria viridis*
	5	3	17~19	31~57	*Artemisia leucophylla, Artemisia capillaris, Sonchus oleraceus,Lespedeza bicolo, Heteropappus altaicus*
	8	8	12~40	18~60	*Lespedeza bicolo, Artemisia capillaris, Potentilla bifurca, Bothriochloa ischaemum, Stipa bungeana*
	11	3	23~37	24~76	*Tripolium vulgare, Lespedeza bicolo, Stipa bungeana, Cleistogenes squarrosa, Artemisia capillaris, Heteropappus altaicus*
	15	3	14~19	39.8~76	*Tripolium vulgare, Lespedeza bicolo, Stipa bungeana, Cleistogenes squarrosa, Stipa grandis, Heteropappus altaicus*
	18	3	22~30	16~49	*Bothriochloa ischaemum, Artemisia leucophylla,Tripolium vulgare, Lespedeza bicolo, Stipa bungeana, Cleistogenes squarrosa, Stipa grandis*
	26	4	22~28	22~69	*Bothriochloa ischaemum, Artemisia leucophylla, Tripolium vulgare, Lespedeza bicolo, Stipa bungeana, Cleistogenes squarrosa*
	30	7	14~29	33~80	*Bothriochloa ischaemum, Artemisia leucophylla, Tripolium vulgare, Lespedeza bicolo, Stipa bungeana, Cleistogenes squarrosa, Stipa grandis*
Shrubland	5	3	12~21	20~38	*Artemisia argyi*、*Artemisia giraldii*、*Lespedeza bicolor*
	10	6	14~32	36~78	*Bothriochloa ischaemum* 、*Stipa bungeana*、 *Artemisia giraldii* 、*Artemisia argyi*
	20	6	21~22	28~53	*Stipa bungeana*、*Artemisia argyi*、*Artemisia giraldii Lespedeza bicolor*、*Melica scabrosa*
	30	3	14~25	21~46.3	*Artemisia argyi*
	36	3	20	46~65	*Stipa bungeana*、*Setaria viridis*、 *Artemisia argyi*、*Setaria viridis*、*Artemisia giraldii*
	47	3	18~24	49~90	*Stipa bungeana*、*Artemisia argyi*、*Artemisia giraldii pamp.*
Forestland	5	3	22~34	36~56	*Stipa bungeana*、*Artemisia argyi*、*Lespedeza bicolor*
	10	3	27.5~33	38~53	*Artemisia argyi*、*Setaria viridis*、*Leymus secalinus*
	20	3	17~26	32~42	*Artemisia argyi*、*Setaria viridis*

	37	3	30~33	53~65	*Artemisia gmelinii*、*Artemisia argyi*、*Stipa bungeana*
	56	3	21~22	49~90	*Stipa bungeana*、*Artemisia argyi*
Nature grassland	>50	4	12~31	34~89.2	*Bothriochloa ischaemum, Artemisia leucophylla, Tripolium vulgare,Lespedeza bicolo, Cleistogenes squarrosa, Stipa grandis*
Nature forest	>100	3	14~29	39~52	*Vittaria flexuosa*、*Syzygium aromaticum*
	>100	3	23~38	35~70	*Artemisia gmelinii*，*Lespedeza bicolor*，*Vittaria flexuosa*
	>100	3	28~45	10~28	*Rosa xanthina*，*Vittaria flexuosa*

Table S2. F and p-values of for independent factors [soil depths, vegetation ages] and their interactions

		SOC stock		Soil TN stock		Soil TP stock		C:N		C:P		N:P	
		F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.
Orchardland	Restoration age	16.12	<0.01	4.63	<0.01	5.56	<0.01	6.27	<0.01	7.95	<0.01	2.24	NS
	Soil depths	150.86	<0.01	57.01	<0.01	845.21	<0.01	0.94	NS	41.02	<0.01	20.52	<0.01
	Restoration age × Soil depths	3.03	<0.01	0.73	NS	0.52	NS	1.07	NS	1.28	NS	0.61	NS
Grassland	Restoration age	6.08	<0.01	2.18	0.03	6.64	<0.01	3.92	<0.01	18.93	<0.01	8.42	<0.01
	Soil depths	160.97	<0.01	148.99	<0.01	1391.63	<0.01	0.79	NS	83.29	<0.01	81.08	<0.01
	Restoration age × Soil depths	1.05	NS	0.67	NS	1.52	NS	0.77	NS	1.25	NS	0.93	NS
Shrubland	Restoration age	45.93	<0.01	23.22	<0.01	3.66	<0.01	14.94	<0.01	46.76	<0.01	24.7	<0.01
	Soil depths	109.93	<0.01	118.15	<0.01	1536.75	<0.01	0.58	NS	52.43	<0.01	80.43	<0.01
	Restoration age × Soil depths	3.92	<0.01	1.42	NS	0.63	NS	1.22	NS	2.01	<0.01	2.18	<0.01
Forestland	Restoration age	6.28	<0.01	9.48	<0.01	0.18	NS	1.11	NS	5.74	<0.01	9.46	<0.01
	Soil depths	10.02	<0.01	25.76	<0.01	118.42	<0.01	3.74	<0.01	7.41	<0.01	11.52	<0.01
	Restoration age × Soil depths	1.13	NS	0.86	NS	0.22	NS	0.46	NS	1.57	NS	1.82	0.03

NS: not significant at $p>0.05$.

Table S3 The slope parameters of the linear regression models for soil organic carbon (SOC), soil total nitrogen (TN), and soil total phosphorus (TP) contents, and C:N, C:P, and N:P ratios with recovery year at different soil depths under four restoration types.

Restoration types	Soil depth (cm)	SOC content (g kg^{-1})		Soil TN content (g kg^{-1})		Soil TP content (g kg^{-1})		C:N		C:P		N:P	
		Equations	R^2	Equations	R^2	Equations	R^2	Equations	R^2	Equations	R^2	Equations	R^2
Orchardland	0-10	y=0.064x+4.030	0.716	y=0.005x+0.557	0.17	y=0.001x+0.618	0.14	y=0.088x+6.491	0.709	y=0.007x+0.892	0.205	y=0.038x+7.410	0.079
	10-20	y=0.020x+3.470	0.436	y=-0.001x+0.501	0.005	y=0.001x+0.601	0.269	y=0.020x+5.783	0.115	y=-0.000x+0.826	0.048	y=0.050x+7.305	0.085
	20-30	y=0.051x+2.381	0.754	y=0.002x+0.353	0.274	y=0.002x+0.579	0.548	y=0.071x+4.090	0.790	y=0.001x+0.607	0.109	y=0.095x+6.815	0.762
	30-50	y=0.039x+1.908	0.324	y=0.000x+0.330	0.01	y=0.002x+0.566	0.685	y=0.052x+3.375	0.243	y=-0.000x+0.579	0.071	y=0.114x+5.999	0.656
	50-100	y=0.019x+2.051	0.111	y=-0.001x+10.286	0.175	y=0.000x+0.572	0.119	y=0.027x+3.566	0.115	y=0.004x+0.497	0.059	y=0.085x+7.280	0.778
Grassland	0-10	y = 0.078x + 3.712	0.643	y = 0.006x + 0.463	0.663	y = -0.000x + 0.571	0	y = 0.126x + 6.814	0.522	y =0.011x + 0.816	0.599	y = 0.036x + 8.302	0.179
	10-20	y = 0.050x + 2.870	0.603	y = 0.003x + 0.371	0.388	y = -0.000x + 0.557	0	y = 0.085x + 5.324	0.516	y = 0.006x + 0.669	0.356	y = 0.043x + 8.094	0.338
	20-30	y = 0.044x + 2.092	0.711	y = 0.001x + 0.030	0.315	y = 0.000x + 0.539	0.007	y = 0.070x + 4.068	0.486	y = 0.003x + 0.563	0.229	y = 0.074x + 7.337	0.444
	30-50	y = 0.029x + 1.873	0.514	y = 0.001x + 0.263	0.096	y = 0.000x + 0.538	0.002	y = 0.047x + 3.619	0.296	y = 0.002x + 0.489	0.063	y = 0.062x + 7.510	0.328
	50-100	y = 0.020x + 1.822	0.273	y = 0.000x + 0.241	0.016	y = -0.000x + 0.542	0.004	y = 0.029x + 3.556	0.106	y = 0.000x + 0.445	0.013	y = 0.021x + 8.610	0.031
Shrubland	0-10	y = 0.101x + 4.362	0.386	y = 0.010x + 0.499	0.461	y = 0.000x + 0.550	0.134	y = 0.032x + 7.728	0.116	y = 0.016x + 0.910	0.476	y = 0.032x + 7.728	0.116
	10-20	y = 0.043x + 3.398	0.198	y = 0.001x + 0.406	0.062	y = -0.000x + 0.537	0.032	y = -0.004x + 8.071	0.002	y = 0.002x + 0.756	0.128	y = -0.004x + 8.071	0.002
	20-30	y = 0.047x + 2.225	0.27	y = 0.000x + 0.300	0.003	y = -0.000x + 0.522	0	y = 0.056x + 7.127	0.345	y = 0.000x + 0.575	0.003	y = 0.057x + 7.127	0.345
	30-50	y = 0.045x + 1.734	0.312	y = -0.000x + 0.261	0.008	y = 0.000x + 0.516	0.019	y = 0.087x + 6.798	0.435	y = -0.000x + 0.507	0.018	y = 0.087x + 6.798	0.435
	50-100	y = 0.038x + 1.548	0.384	y = 0.000x + 0.226	0.03	y = 0.000x + 0.521	0.041	y = 0.059x + 7.376	0.356	y = 0.000x + 0.434	0.023	y = 0.059x + 7.376	0.356
Forestland	0-10	y = 0.143x + 3.557	0.979	y = 0.015x + 0.466	0.981	y = 0.000x + 0.569	0.066	y = 0.243x + 6.227	0.995	y = 0.025x + 0.814	0.521	y = 0.035x + 8.584	0.697
	10-20	y = 0.049x + 2.795	0.821	y = 0.006x + 0.374	0.823	y = -0.000x + 0.563	0.024	y = 0.093x + 4.906	0.827	y = 0.012x + 0.657	0.452	y = 0.010x + 8.172	0.238
	20-30	y = 0.028x + 2.045	0.894	y = 0.003x + 0.300	0.889	y = -0.000x + 0.552	0.109	y = 0.057x + 3.677	0.917	y = 0.007x + 0.538	0.484	y = 0.014x + 7.319	0.202
	30-50	y = 0.007x + 1.830	0.205	y = 0.001x + 0.258	0.193	y = -0.000x + 0.545	0.226	y = 0.017x + 3.342	0.298	y = 0.003x + 0.472	0.351	y = -0.005x + 7.433	0.012
	50-100	y = 0.000x + 1.725	0	y = 0.010x + 0.125	0.001	y = -0.000x + 0.543	0.016	y = 0.001x + 3.178	0.005	y = 0.019x + 0.240	0.677	y = 0.018x + 7.463	0.164

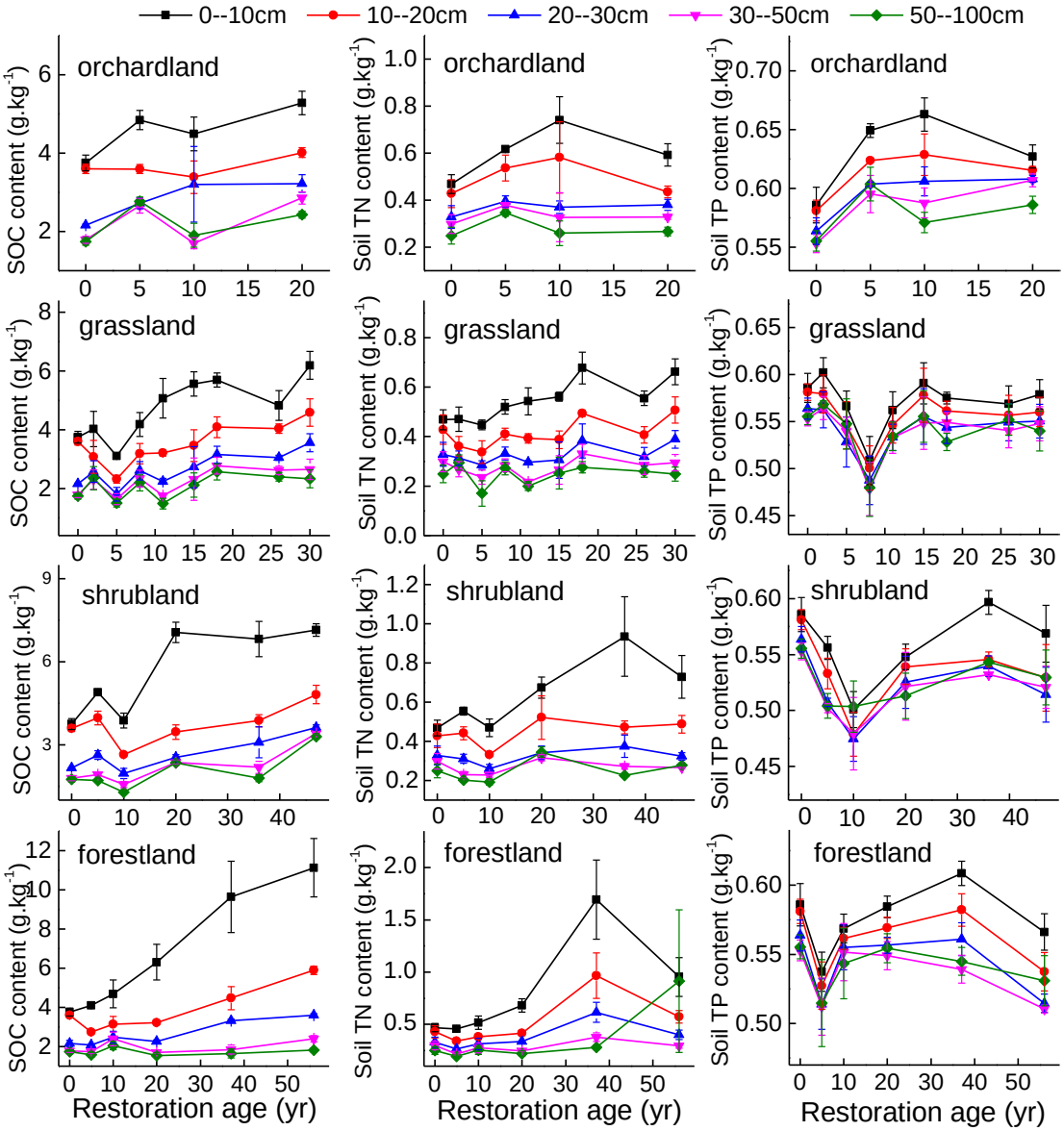

Figure S1: Changes in soil organic carbon (SOC), soil total nitrogen (TN), and soil total phosphorus (TP) content with restoration age. Note: Values are mean ± standard error.

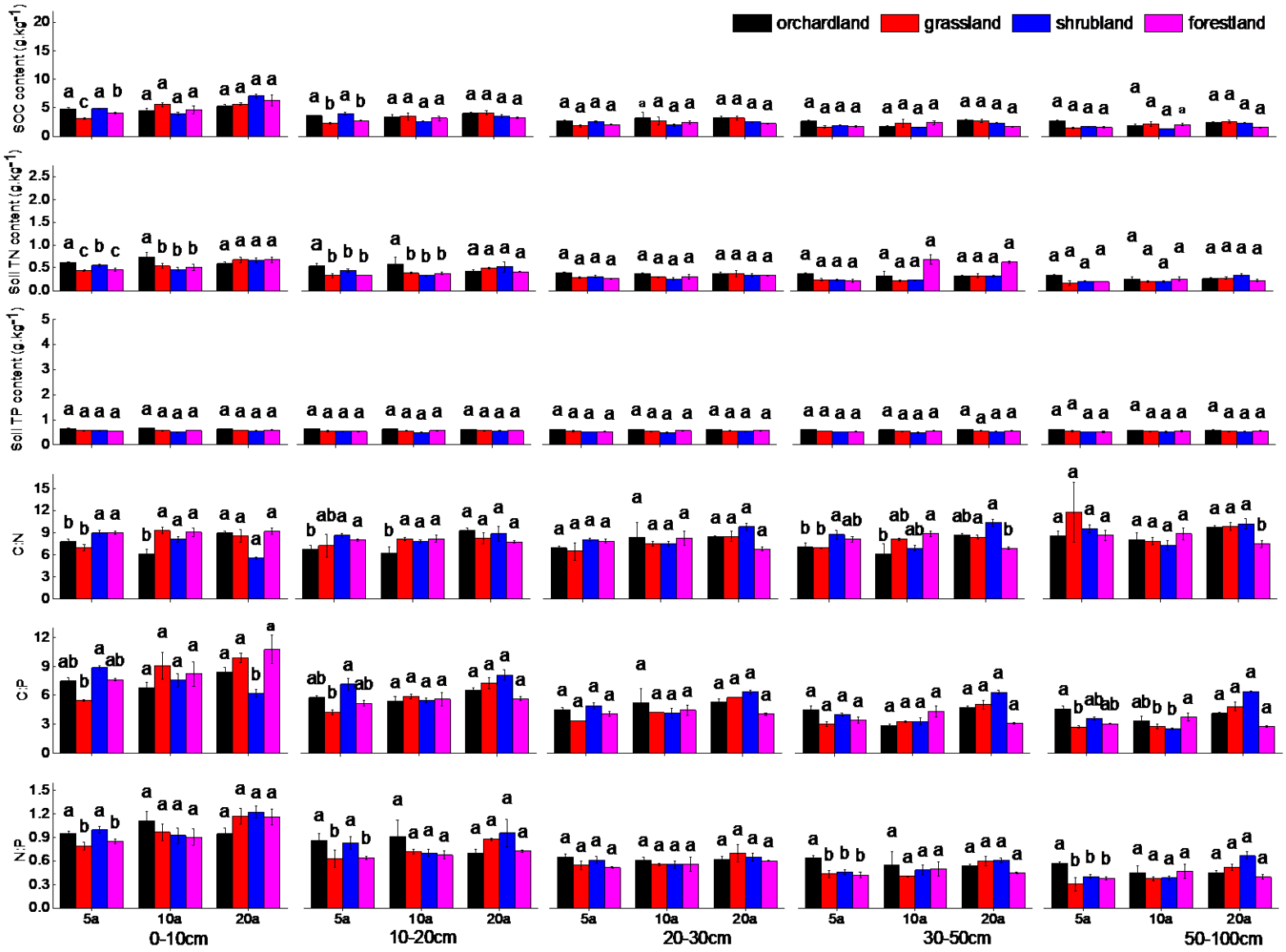
orchardland
grassland
shrubland
forestland
SOC content (g.kg-1)
Soil TN content (g.kg-1)
Soil TP content (g.kg-1)
C:N
C:P
N:P
5a
10a
20a
0-10cm
10-20cm
20-30cm
30-50cm
50-100cm

Figure S2: Changes in content and stoichiometry of soil organic carbon (SOC), soil total nitrogen (TN), and soil total phosphorus (TP) for different vegetation types at 5, 10, and 20 years. Note: Values are mean ± standard error.